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AUTHOR Welty, Gordon; Lundin, Edward
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ABSTRACT

The structure of an organization plays a vital role in the evaluation of the organization. Social science researchers often assume that controls inherent in the physical sciences are as applicable to human subjects. Evaluation of Head Start is an example of the social relation of investigator to subject matter and of the variables introduced by the organizational structure of a complex research enterprise. (MLF)

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MANAGEMENT STRUCTURES AND LARGE-SCALE STUDIES

Gordon Welty

Edward Lundin

Research for Better Schools, Inc.
Philadelphia, Pennsylvania

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Management Structures and Large-Scale Studies

We will discuss today an aspect of large-scale research which has received little attention from the educational researcher, the organization and management of the action project under study. This problem includes the examination and development of the theory of the organization and management of social change. Not only are such investigations desirable and possible, they are necessary. As we shall see, the very structure of a project undergoing an evaluative study may preclude a meaningful evaluation, if that structure is not explicitly considered.

We will consider first the organizational model for the classical experimental design, and find it to be the rational or synoptic model. When we turn to large-scale research, we will find that this rational organizational model is inappropriate.

Since science is a collaborative and cumulative human activity, it is a social activity. It has been long recognized that the relationship among scientists constitutes a social system, and recently great concern has been exhibited for instance by the American Psychological Association, for the specific nature of this social organization.

There is, however, a second aspect of the social nature of scientific activity which has only recently received systematic attention. It is now clear that between the scientist and his subject matter exists a social relationship as critical to the scientific endeavor as that between scientists. It is the social relation of investigator to subject matter to which we will attend.

The traditional view of the social system of investigation and subject matter was that of the rational or synoptic model. We will

briefly summarize the suppositions of this model here. A more complete discussion is available in our AERA paper this year. The investigator is assumed to have complete knowledge about the subject matter, complete control over all variables, and perfect foresight as to the consequences of any act. In the literature the assumption prevailed that all participants maximized their individual utilities and, hence, adhered to maximizing behaviors.

Such suppositions about the relationship of investigator to subject matter can be maintained in the physical sciences because inputs and processes are sufficiently inert and uniform to permit both generalizability and causal understanding. Consider, for instance, a typical physics experiment.

The research question is, What is the relation between force and change in velocity? To ascertain the answer, an experiment is undertaken. The inputs include a billiard ball on a glass surface, the treatment consists of a constant force applied by a spring loop, and the observation is made by flash photography at 10/24 of a second.

Assurances of control, complete foresight, omniscience, etc. are built into this force and velocity experiment. Questions of control are dealt with by using standardized instruments. The physical science researcher knows that a specified photoflash camera will take one frame every 10/24 second; further that the billiard ball will be virtually frictionless, certified so by previous experiments, and that spring loops respond to given forces in predictable ways. Complete foresight is assured by the predictive powers of the experimental results. Knowing the appropriate formula, the researcher derives the solution 14 cm/sec^2. He thus generalizes for <u>all time</u> that under the influence of a constant force the velocity changes in direct proportion to the time

the force acts. Finally, the omniscience, which warrants the supposition that his generalization is valid, is due to his ability, so to speak, to close the laboratory door. Indeed, he doesn't even need to calculate an F-ratio, his predictive accurace is so good.

The nature of the subject matter under investigation, hence the relationship between researcher and subject, changes when these controls and optimal conditions are relaxed. This is particularly the case when the subject is a human rather than inert matter. Yet, researchers in the social context often assume (at least implicitly) that controls inherent in the physical science situation also obtain with human subjects.

Economists have long recognized the shortcomings of the rational model. Hence, they, the developers of this model, have also noted its inappropriateness for wholesale use in social situations. We will sketch these shortcomings here. They are three in number. The first can be called the <u>personal</u> or computational shortcoming. An individual simply lacks the abilities, for instance of data processing, that the rational model requires. He is a finite automaton, and it has been proved by Gerald Kramer that this type of data processing or calculating mechanism simply cannot handle the infinitely large quantities of inputs from the environment, which the classical model supposes. It is not possible in the social situation to close the laboratory door, if for no other reason, because the subjects have a history which is germane to their present behavior. One way to deal with this shortcoming is to introduce random assignment into the research project. Thereby the number of factors which the research manager must consider are reduced, hopefully to a manageable size. But now the system under consideration is not represented by a rational model, but rather a stochastic model.

A second sort of shortcoming may be called the social psychological. Individuals do not live in the cultural vacuum of Robinson Crusoe as the classical model supposes. In the case of the physics experiment, there is no social interaction of subject matter and investigator; the subject matter is utterly inert. The social reality of human subjects is rather as von Neumann and Morgenstern point out, one of strategic independence. The investigator interacts, strategically, with the subjects. This fact radically modifies the nature of the system under study, and the rational model is simply inapplicable. The relevant model becomes that of the theory of games of strategy.

The third shortcoming of the rational model is organizational. It is supposed that there is no difference in operating characteristics of a myriad of differing organizational patterns. It is to the inapplicability of this assumption that we turn.

In spite of the recognition of the myriad of social mechanisms which constrain rationality, numerous evaluation studies assume a priori that the social system of the research activity has the characteristics of the rational model of organizations. For example, most ESEA Title I evaluative reports are based either on the one-shot case study type of design or else the analysis of covariance design. These designs assume a stable organizational framework in which the program operates.

For instance, the Westinghouse-Ohio University study of Headstart utilized the covariance analysis of variance design for that nationwide study. It was assumed, by virtue of the design employed, that the organization of the Headstart program was classical; that is that each classroom of the Headstart installation was directly related to the installation's central management. There was no problem of organization for these researchers because it was supposed that the rational model is

realized. As Edward McDill and his colleagues noted, these suppositions are false. This point needs no further emphasis.

The ramifications of such suppositions for the acceptance of the null hypothesis concerning the performance of Headstart versus non-Headstart children does warrant emphasis. For on the basis of just such an analysis, it was judged that the Headstart children performed no better than their peers who had not attended Headstart.

Since all the possible sources of variation, such as distortion of information, etc., are eliminated in the classical model by an assumption such as Krathwohl's "typicality of situations," we can suppose that for the purposes of the Westinghouse-Ohio University study, the global and local performance indices coincide. The presumption is that the system is optimized in global and local terms.

Let us now introduce some complications to our model, in the interest of realism. The global performance index consists of the local performance indices combined with the indices of the losses due to organizational structure. We will assume that there are losses in performance incurred by the biases and noise introduced by communication.

It follows that as a message comes down through an organization, level to level, from say the principal to the classroom teacher, it will suffer communication loss at each level. Thus it becomes impossible to insure that what happens at the local level conforms to what is expected to happen from the global level. As a timely example, the New York Times related in March of this year how a General named William Peers completed an investigation of the My Lai incident in Viet Nam. Peers estimated that 150 to 200 noncombatant civilians were killed. As reports of the incident travelled up the organization, from company level, to brigade, to the division level, the numbers decreased, until the reports

were twenty to thirty killed. This is a good example of communication loss in a heirarchical structure, conforming to what one would expect in a realistic model of organizations such as that of Anthony Downs.

Thus we must expect that the mere existence of organization will be a relevant factor in large-scale systems such as the national Head-start program.

This evidence means that the researcher cannot argue that the Head-start system was optimized at the local level. We seek, however, to prove the stronger contention that Headstart was <u>not</u> homogeneous at the local level, as the rational model supposes and as the covariance model assumes.

If the number of levels between, say, principal and classroom teacher varies, then the amount of loss due to organization or communications will vary from classroom to classroom. We will call such an organizational pattern idiosyncratic. By a theorem due to the Polish mathematician Kulikowski, it can be shown that the project manager must be more stringent in resource allocations to the classrooms with the greater number of levels in the idiosyncratic heirarchy. Conversely, the researcher should expect a lower level of output in the classroom with the lesser number of levels.

Where the organizational structure is symmetrical, the manager must not distinguish between classrooms in his resource allocations. It goes without saying that the typical large-scale research enterprise has an organizational structure more idiosyncratic than the symmetric structure. Perfect heirarchies are the exception rather than the rule. It follows that organizational structure of a complex research enterprise introduces variance into the criterion measure. If the program makes equal resource allocations per classroom, then outputs per

classroom will differ in a systematic fashion. On the other hand, to guarantee equality of output, say to meet a mandate for equality of educational opportunity, the program manager must vary inputs in a systematic fashion. But the latter is a prima facie denial of the typicality of situations.

When we examine the organizational structure which characterized Headstart, we will find that the structure was idiosyncratic. Yet the research design employed supposed, as we have noted, that the structure was symmetric.

Within the classroom, the organization of the Headstart project was reasonably uniform across the nation. For instance, the Department of Health, Education and Welfare, in 1967, reported that in the full-year program, 23% of the staff nationwide were teachers and 30% were teacher's aides. Thus there was roughly a pairing of teacher and aide.

Especially interesting, however, was the structure of the Get Set program in Philadelphia. This large city example of Headstart had about ten Supervisors, each of which had charge of about ten Centers. The organizational pattern here was strictly symmetrical.

Within each Center in Philadelphia were various numbers of teachers, ranging from a couple to 9 or 10. Each teacher was assigned one teacher's aide. One of the teachers was designated Lead Teacher and channeled all messages from any source up to the Supervisor in charge of that Center, and relayed the Supervisor's comments down to the teachers and aides. The lead teacher also was assigned one aide, and had a classroom of her own. This patter was thought necessary because of the large number of teachers, classrooms, etc. Hence we find in Philadelphia that pattern of organization which we have labelled idiosyncratic.

In one classroom per Center in Philadelphia, the classroom of the lead teacher, there was less information and communication loss than in the other classrooms. Thus by Kulikowski's Second Theorem, the researcher would expect a lower level of performance exhibited by the students in the lead teacher's room than in the other classrooms.

As we've noted, there is evidence of similar organizational variation elsewhere in the nation. Thus we might suppose that this expectation would be held by any researcher engaged in global and national evaluative studies. Yet the Coleman study of Equality of Educational Opportunity, the Westinghouse-Ohio University study, etc., which are examples of recent national studies, give no indication of this concern.

In conclusion, we would like to re-emphasize that in large-scale research and evaluation endeavors, the project's organizational structure itself becomes a source of variance in the research findings. Before the researcher publishes his findings of no significant differences, he would do well to consider the effect of this variance on the denominator of an F-ratio. Certainly more accurate data than our illustrative cases are needed to ascertain the effect of structural variation. Such accurate data does not at present exist.

We are not at all saying that large-scale research projects are undesirable, nor are we saying in this age of computers that they are unfeasible. As Richard Light has recently argued in the Harvard Educational Review, such projects are feasible if properly conceptualized. We merely say that they must be better conceptualized than they have been to date. Mr. Lundin's paper will discuss an attempt to better conceptualize the problems of national programs and their evaluation.

REFERENCES

-- Campbell, D. T. and J. Stanley, Experimental and Quasi-Experimental Designs for Research, Chicago: Rand McNally & Co. (1966).

-- Cicirelli, V. G. et al, The Impact of Head Start Vol. I, Westinghouse Learning Corporation and Ohio University (1969).

-- Coleman, J. S. et al, Equality of Educational Opportunity, Washington, D. C.: U. S. Government Printing Office (1966).

-- Downs, A., Bureaucratic Structure and Decision-Making, Santa Monica: RAND Corporation (1966).

-- Garvey, W. D. and B. C. Griffith, Reports of the American Psychological Association Project on Scientific Information Exchange in Psychology, Washington, D. C.: APA (1963-1965).

-- Kramer, G., "An Impossibility Result Concerning the Theory of Decision-Making" in J. L. Bernd ed., Mathematical Applications in Political Science Vol. III, Charlottesville: University Press of Virginia (1967).

-- Krathwohl, D., "A Paradigm for the Development of Research Designs." A paper presented at the American Educational Research Association, 1970 Annual Meeting: Minneapolis (1970).

-- Kulikowski, R., "Optimum Control and Synthesis of Organizational Structure of Large-Scale Systems," in H. Kuhn and G. Szegö eds., Mathematical Systems Theory and Economics Vol. II, Berlin: Springer Verlag (1969).

-- Light, R. J. and P. V. Smith, "Choosing a Future," Harvard Educational Review 40 (1970).

-- Lundin, G. E. and G. A. Welty, "The Relevance of a Managerial Decision-Model to Educational Administration." A paper presented at the American Educational Research Association, 1970 Annual Meeting: Minneapolis (1970).

-- McDill, E. L. et al, Strategies for Success in Compensatory Education, Baltimore: John Hopkins Press (1969).

-- U. S. Department of Health, Education and Welfare, Office of Child Development, Project Headstart: 1965-1967, Washington, D. C. (n.d.).

-- von Neumann, J. and O. Morgenstern, Theory of Games and Economic Behavior, Princeton: Princeton University Press (1947).